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California Regional Water Quality Control Board
Central Valley Region

08-AFC-12

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REVIEW - REPORT OF WASTE DISCHARGE – LINED WASTEWATER EVAPORATION POND, SAN JOAQUIN SOLAR 1 & 2 LLC, HYBRID POWER PLANT PROJECT, FRESNO COUNTY

On 18 November 2009, URS Corporation (URS), on behalf of Martifer Renewables Solar Thermal LLC (Martifer), incorporated in the state of Delaware, submitted the *Report of Waste Discharge - Lined Wastewater Evaporation Pond - San Joaquin Solar 1 & 2 Hybrid Power Plant Project* (ROWD). The ROWD includes a signed Form 200, and was submitted to obtain waste discharge requirements (WDRs).

Martifer proposes to construct and operate San Joaquin Solar 1 LLC and San Joaquin Solar 2 LLC, two hybrid solar thermal electricity generating plants (Project) in western Fresno County about six miles east of the City of Coalinga. A Class II lined surface impoundment, constructed in accordance with Title 27, California Code of Regulations, Section 20005 et seq. (Title 27) is proposed for the discharge of process wastewater for evaporation. The property on which the proposed surface impoundment is to be constructed is owned by William J. Mouren Farming, Inc. (Mouren Farming).

Martifer is proceeding with a certification process for the proposed Project with the California Energy Commission (CEC), who acts as the lead permitting agency under the California Environmental Quality Act for electrical generation plants. In accordance with the Public Resource Code governing CEC activities and power plant licensing, the facility certification process acts as "in lieu" of any permit required by any State agency, and is also functionally equivalent to an environmental impact report. Draft WDRs prepared by the Central Valley Regional Water Quality Control Board (Central Valley Water Board) staff, naming both Martifer and Mouren Farming as responsible parties, will be submitted to the CEC as part of the certification process.

The proposed primary water supply for the Project is recycled water conveyed via a pipeline from a wastewater treatment facility (WWTF) which has yet to be constructed by the City of Coalinga about two miles west of the Project. Groundwater from an existing onsite supply well will augment, as needed, the primary supply and until construction of the WWTF would supply 100 percent of the water. The water balance diagram (Fig. 5 of the ROWD), indicates that Project wastewater is from two sources with nine gallons per minute (gpm) from the sand filter backwash and six gpm from the tertiary treatment system used to treat the recycled water from the WWTF. To provide operational flexibility, the ROWD includes an additional two gpm of wastewater for a total wastewater discharge of 17 gpm.

Based on the **estimated** wastewater quality provided in the ROWD, the concentrations of several constituents in the wastewater exceed those from samples from the onsite groundwater supply well. The wastewater may therefore be currently considered a designated waste as defined in California Water Code Section 13173. Designated waste is waste which, under ambient environmental conditions at a waste management unit, could be released in concentrations exceeding applicable water quality objectives or that could reasonably be expected to affect beneficial uses of the waters of the state as contained in the appropriate state water quality control plan. The wastewater could present a threat to underlying groundwater, and is therefore subject to containment in accordance with the requirements set forth in Title 27. Groundwater in the area is currently used for agriculture and is designated in the *Water Quality Control Plan for the Tulare Lake Basin, Second Edition* (Revised 2004), as having beneficial uses for municipal and domestic (MUN), agricultural supply (AGR), and industrial service supply (IND). Martifer currently is proposing an onsite evaporation surface impoundment constructed with an engineered alternative liner system for wastewater containment in accordance with Title 27.

After reviewing the information submitted in the ROWD and additional information submitted to the CEC, Central Valley Water Board staff has determined **the ROWD is incomplete.** Martifer needs to address the following:

1) The water balance diagram in the ROWD shows liquid from the filter press being recycled back to the soda lime reactor clarifier at a rate of 46.4 gpm and another 3.6 gpm of liquid being discharged to an unknown location. The unknown location for the liquid discharged from the filter press will need to be identified. It needs to be clarified whether the filter press liquid is to be discharged to the surface impoundment. Information needs to be submitted to account for this additional wastewater volume and quality, and a new water balance and treatment system process may be needed.

2) A copy of the signed written agreement with Mouren Farming to lease the three identified property parcels will need to be submitted.

3) Table 4.3-1 in the ROWD contains estimated concentrations for 12 chemical constituents in the proposed wastewater discharge. Final wastewater characteristics need to be provided once they have been determined. Changes in the wastewater quality, depending upon the source, could result in a determination that the wastewater may not be subject to regulation in accordance with Title 27. A new water balance and treatment system process utilizing only groundwater as the supply source for the project will need to be submitted.

4) Section 5 of the ROWD describes how the leachate collection and removal system (LCRS) sump will contain "a fail-safe mechanism" designed to prevent the sump from overflowing with leachate and that "a 40-mil HDPE-lined pan lysimeter will be constructed under the LCRS sump(s)." Section 20340(c) of Title 27 requires that the depth of fluid in the sump be kept at the minimum needed to ensure efficient pump operation so **no buildup of hydraulic head occurs on the liner**.

   As prescribed by Section 21760 of Title 27, detailed preliminary design plans and specifications for the liners, LCRS components, leak detection system components [i.e., pan lysimeter(s)], precipitation and drainage control facilities, and information regarding any related ancillary facilities that could have an effect on water quality will need to be submitted.

5) A surface impoundment construction quality assurance (CQA) plan as prescribed in Section 20324 of Title 27 will need to be submitted. The attached checklists should be reviewed when preparing the plan.

6) Three groundwater detection monitoring wells are proposed at the locations shown on Figure 6 of the ROWD. To provide initial background water quality data, Martifer proposes that at least one well be sampled a minimum of four times prior to the discharge of wastewater to the surface impoundment.

   Depending on the initial hydrogeologic data obtained from the three proposed wells, additional groundwater monitoring wells or hydrogeologic information may be required to establish an appropriate detection monitoring system. Boron needs to be added to the proposed list of constituents to be analyzed. Monitoring wells need to be developed until field parameters have stabilized.

7) Section 21750 of Title 27 provides a list of "Waste Management Unit Characteristics and Attributes to be described in the ROWD." The following items relate to the Project and will need to be submitted:

   a) Whether the proposed surface impoundment is located within a 100-year floodplain;

   b) Additional climatology data including an isohyetal map, estimated maximum and minimum annual precipitation, the reference or calculations used to determine the estimated precipitation amount of 3.5 inches for the 1,000-year, 24-hour storm event, and estimated runoff volume from the site including the peak discharge from the 1,000-year, 24-hour storm event;

   c) A stability analysis of the proposed surface impoundment including a determination of the expected peak ground acceleration associated with the maximum credible earthquake;

   d) A review of historical seismicity and other information in accordance with paragraph (f)(7) Fault Identification & Proximity, will need to be included with the stability analysis;

   e) Current geologic data presented in the CEC document will need to be updated following the installation of the groundwater detection monitoring system or other site characterization;

   f) A map showing the location of all groundwater wells within one mile of the Project including the names and addresses of the current well owners;

   g) The current land use and estimated future use of groundwater within one mile of the Project; and

   h) A preliminary closure and post-closure maintenance plan that meets the requirements in Section 21769.

8) Water Code Section 13260(d)(1)(A) states that each person who submits a ROWD shall submit an annual fee according to a fee schedule. The initial fee is equivalent to the regular annual fee which all dischargers regulated by WDRs must pay as prescribed in Title 23, Section 22000 of the California Code of Regulations. The annual fee amount is determined based on the Threat to Water Quality (TTWQ) rating and Complexity (CPLX) rating. Central

Valley Water Board staff has determined the TTWQ rating is 2 and the CPLX rating is B for the Project. Therefore, the first year annual fee amount is $12,240 plus a 9.5 percent ambient water monitoring surcharge. The ROWD will not be considered complete until the first year annual fee of $13,402.80 is received.

Central Valley Water Board staff can begin drafting WDRs after the above comments are addressed by Martifer and it is determined that the ROWD is complete.

If you have any questions, please contact Douglas Wachtell at dwachtell@waterboards.ca.gov or (559) 445-5114.

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Attachments

cc: Felicia Miller, CEC, Sacramento
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Anne Runnalls, URS, San Diego
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ATTACHMENT __

QUALITY ASSURANCE CHECKLIST FOR LANDFILL GEOSYNTHETIC LINERS AND COVERS

Facility Name: Design Review Date:

HDPE GEOMEMBRANE MANUFACTURING QUALITY ASSURANCE (MQA) AND CONSTRUCTION QUALITY ASSURANCE (CQA) TESTING

Test Parameter	Test Method(s)[1]	Recommended Frequency	Required* or Recommended Criteria	Proposed Frequency	Proposed Criteria
MQA					
Resin Density	D 792A D 1505	One per batch	0.934 to 0.940 grams per cubic centimeter		
Resin Properties	D 1248	One per batch	At least 97 percent resin: Virgin polymers (regrind O.K.)		
Melt Flow Index (Resin)	D 1238	One per batch	0.1 to 1.0 grams per 10 minutes		
Geomembrane Density	D 792B D 1505	One per 500,000 square feet (One per 200,000 lb)	0.941 to 0.954 grams per cubic centimeter		
Geomembrane Thickness	D 5199 D 5994[2]	One per roll	60 mils* nominal min. avg.; Lowest of 10 values 54 mils[4]		
Carbon Black Content	D 1603 D 4218	One per 50,000 square feet (One per 20,000 lb)	2 to 3%; Group 3 or lower		
Carbon Black Dispersion	D 5596	One per 100,000 square feet (One per 45,000 lb)	Minimum 8 of 10 views in Category 1 or 2		
Tensile Properties	D 6693 Type IV[3]	One per 50,000 square feet (One per 20,000 lb)	≥ 126 lb/in yield strength[4] ≥ 12 percent strain at yield[4] ≥ 228 lb/in break strength[4] ≥ 700 percent strain at break[4]		
Environmental Stress Cracking	D 5397 GRI GM-13	One per 200,000 lb[5]	≥ 200 hours ≥ 300 hours		
Oxidative Induction Time of Polyolefins	D 3895 D 5885	One per 200,000 lb[5]	≥ 100 min. ≥ 400 min.		
Oven Aging @ 85° C	D5721 D3895 D5885	Per each formulation	≥ 55% retained after 90 days ≥ 80% retained after 90 days		
UV Resistance	D5885	Per each formulation	≥ 50% retained after 1600 hrs		
Puncture Resistance	FTMS 101C, Method 2065 D 4833	One per 100,000 square feet (One per 45,000 lb)	≥ 72 pounds[4] ≥ 108 pounds[4]		
Tear Resistance	D 1004, Die C	One per 100,000 square feet (One per 45,000 lb)	≥ 42 pounds[4]		
Asperity Height	GRI GM-12[6]	Every 2nd roll	≥ 10 mils[7]		
CQA					
Geomembrane Thickness	D 5199 D 5994[2]	One per 100,000 square feet	57 mils nominal min. avg.; lowest 8 of 10 values 54 mils; lowest of 10 values 51 mils[10]		
Tensile Properties	D 6693 Type IV[3]	One per 100,000 square feet	≥ 126 lb/in yield strength[10] ≥ 12% strain at yield[10] ≥ 90 lb/in break strength[10] ≥ 100% strain at break[10]		
Puncture Resistance	FMTS 101C, Method 2056 D 4833	One per 100,000 square feet	≥ 72 pounds[10] ≥ 90 pounds[10]		
Tear Resistance	D 1004, Die C	One per 100,000 square feet	≥ 42 pounds[10]		
Interface Shear Strength	D 5321 D 6243	One per project	*****		
Seam Shear	D 6392 GRI GM-19	One per 500 lineal feet (or see Special Note)	95% of min. yield strength [Choose from Table 1, right]		
Seam Peel	D 6392 GRI GM-19	One per 500 lineal feet (or see Special Note)	Extrusion: 62% yield & ftb[8] Fusion: 72% yield & ftb[8] [Choose from Table 1, right]		
Nondestructive Seam Test	D 5820 (Pressure Test) D 5641 (Vacuum Box) D 6365 (Spark Test)	Continuous	30 p.s.i. for 5 min. (Dual Seam) 3 p.s.i. for 5 sec. (Extrusion) No spark		
Electrical Leak Location	D 6747 (Selection Process) D 7002 (Water Puddle)[9] D 7007 (Water/Earth) D 7240[11]	Once on constructed liner	 Max. 1 mm dia. hole sensitivity Max. 6 mm dia. hole sensitivity		

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Notes: Testing to be performed i.a.w. GRI GM13.

*Required by 40 CFR, Part 258 (Subtitle D), for HDPE liner only.

[1]ASTM Test Method, unless otherwise noted. Results of all tests performed to be reported as per method reporting criteria.

[2]Test Method for Measuring Core Thickness of Textured Geomembranes (used for textured geomembranes only).

[3]Replaces ASTM D 638.

[4]Typical value for 60-mil smooth HDPE. See also Tables 3 and 4.

[5]Approximately one per 500,000 ft² for 60-mil thickness.

[6]Asperity Measurement of Textured Geomembranes Using a Depth Gage (used for textured geomembranes only).

[7]Of 10 readings, 8 of 10 must be ≥ 7 mils, and lowest individual reading must be ≥ 5 mils.

[8]ftb = film tear bond

[9]Not applicable for covered geomembranes.

[10]Typical value for 60-mil textured HDPE. See also Tables 3 and 4.

[11]Conductive Geomembrane Spark Test (2006).

TABLE 1: SEAM STRENGTH AND RELATED PROPERTIES OF THERMALLY BONDED SMOOTH AND TEXTURED HDPE GEOMEMBRANES (GRI GM-19)

Geomembrane Nominal Thickness	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Hot Wedge Seams[1]							
Shear strength,[2] lb/in.	57	80	100	120	160	200	240
Shear elongation at break,[3] %	50	50	50	50	50	50	50
Peel strength,[2] lb/in.	45	60	76	91	121	151	181
Peel separation, % (max.)	25	25	25	25	25	25	25
Extrusion Fillet Seams							
Shear strength,[2] lb/in.	57	80	100	120	160	200	240
Shear elongation at break,[3] %	50	50	50	50	50	50	50
Peel strength,[2] lb/in.	39	52	65	78	104	130	156
Peel separation, % (max.)	25	25	25	25	25	25	25

[1]Also for hot air and ultrasonic seaming methods.

[4]Value listed for shear and peel strengths are for 4 out of 5 test specimens; the 5th specimen can be as low as 80% of the listed values.

[3]Elongation measurements should be omitted for field testing.

TABLE 2: FIELD SEAMING METHODS FOR VARIOUS GEOMEMBRANES
A = method is applicable
n/a = method is not applicable

Seaming Method	Geomembrane Type					
	HDPE	LLDPE	fPP	PVC	CSPE-R	EPDM-R
Extrusion (fillet or flat)	A	A	A	n/a	n/a	n/a
Thermal fusion (hot wedge & hot air)	A	A	A	A	A	A
Solvent (and bodied solvent)	n/a	n/a	n/a	A	A	n/a
Adhesive (chemical & contact)	n/a	n/a	A	A	A	

Source: GFR, May 2004, p. 25.

Special Note: Destructive seam test frequencies may be proposed based on the following:
GRI-GM14 (Method of attributes) – changing sampling frequency based on failure rates (for projects ≥ 25 ac.);
GRI-GM20 (Control chart method) – changing sampling frequency based on preset control limits (any size project).
(Source: GFR, May 2004, pp. 26-27.)

TABLE 3: TENSILE STRENGTH AND RELATED PROPERTIES OF SMOOTH AND TEXTURED HDPE GEOMEMBRANES (GRI GM-13)[1]

Smooth HDPE	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Yield strength (lb/in)	63	84	105	126	168	210	252
Break strength (lb/in)	114	152	190	228	304	380	456
Yield elongation	12%	12%	12%	12%	12%	12%	12%
Break elongation	700%	700%	700%	700%	700%	700%	700%
Tear Resistance (lb)	21	28	35	42	56	70	84
Puncture Resistance (lb)	54	72	90	108	144	180	216
Textured HDPE	30 mils	40 mils	50 mils	60 mils	80 mils	100 mils	120 mils
Yield strength (lb/in)	63	84	105	126	168	210	252
Break strength (lb/in)	45	60	75	90	120	150	180
Yield elongation	12%	12%	12%	12%	12%	12%	12%
Break elongation	100%	100%	100%	100%	100%	100%	100%
Tear Resistance (lb)	21	28	35	42	56	70	84
Puncture Resistance (lb)	45	60	75	90	120	150	180

[1]All values are minimum averages.

TABLE 4: NSF SPECIFICATIONS FOR PUNCTURE RESISTANCE AND TENSILE STRESS AND STRAIN AT YIELD OF HDPE GEOMEMBRANES*

Nominal Thickness (mils)	40	60	80	100
Puncture Resistance (FTMS 101)*	48 lb	72 lb	96 lb	120 lb
Puncture Resistance (ASTM D4833)	60 lb[1]	90 lb[1]	120 lb[1]	150 lb[1]

*Source: NSF, 1991, "Flexible Membrane Liners, Standard 54," Rev. Ed., May 1991, National Sanitation Foundation, Ann Arbor, MI.

[1]Equivalent value using probe diameter ratio 8/6.35 = 1.26.

Additional CQA Features:
HDPE panel deployment log (final construction report to include as-built drawing)

ATTACHMENT __

CONSTRUCTION QUALITY ASSURANCE (CQA) CHECKLIST FOR LANDFILL MONOLITHIC FINAL COVER LAYER

Facility Name: Design Review Date:

MONOLITHIC COVER BORROW MATERIAL EVALUATION (PRIOR TO COMPACTION)[X]

Test Parameter	**Required** or Recommended Test Method[1]	**Required** or Recommended Frequency	Recommended Criteria	Proposed Frequency	Proposed Criteria
Compaction Curves	**D 1557[A] (Modified Proctor)**	**One per 5,000 yd^3 and/or change in material[B]**	n.a.		
Grain Size Distribution	**D 422[A] (Sieve)**	One per 5,000 yd^3 or change in material[2]	n.a.		
Soil Classification	**D 2487[A] (USCS)**	One per 5,000 yd^3 or change in material[2]	Well-graded, amenable to compaction		
Atterberg Limits	**D 4318[A] (LL,PL,PI)**	**One per 5,000 yd^3 and/or one per week[B]**			
Lab Permeability	**D 5084[A][3] (Triaxial)**	One per 7,500 yd^3 or change in material[2]			
Capillary-Moisture Relationships	D 2325 (Coarse-grained) D 3152 (Fine-grained)	One per 5,000 yd^3 or change in material[2]			
Moisture Retention Characteristics	D 6836	One per 5,000 yd^3 or change in material[2]			

MONOLITHIC COVER COMPACTION TESTING

Test Parameter	**Required** or Recommended Test Method(s)[1]	**Required** or Recommended Frequency	Recommended Criteria	Proposed Frequency	Proposed Criteria
Soil Classification	**D 2488[C] (Visual-Manual)**	Five per acre per lift	Rounded to subrounded clasts		
In-Place Moisture					
Overnight Method	D 2216 (Oven)	One per 10 rapid tests	90 percent of optimum moisture content[D]		
Rapid Field Methods[4]	D 3017 (Nuclear) D 4643 (Microwave) D 4944 (CaC_2 Gas) D 4959 (Direct Heat)	Five per acre per lift			
In-Place Density					
Conventional Field Methods	D 1556 (Sand Cone) D 2167 (Balloon)	One per 20 rapid tests	80 to 85 percent of maximum dry density[5]		
Rapid Field Methods[6]	D 2922 (Nuclear) D 2937 (Drive Cylinder)	**Four per 1,000 yd^3** (3/ac./lift) **or four per day[B]**			
Construction Oversight	Visual Observation	Continuous	n.a.		
Foundation Layer Thickness	Surveying Measurement	At 50-foot centers	48 inches[D]		

Notes:

[A]Required by California Code of Regulations, Title 27, §20324(e).

[B]Required by California Code of Regulations, Title 27, §20324(h); greater of the two frequencies listed.

[C]Required by California Code of Regulations, Title 27, §20324(f).

[D]Minimum thickness recommended to replace overall thickness of prescriptive standard final cover system as required by California Code of Regulations, Title 27, Division 2, §21090(a). Acceptable civil engineering practice includes placing layer in up to one-foot compacted lifts.

[X]See also "Technical and Regulatory Guidance for Design, Installation, and Monitoring of Alternative Final Landfill Covers," in *Interstate Technology & Regulatory Council, Alternative Landfill Technologies Team, Technical and Regulatory Guidance Document* (December 2003), Table 4-1 (p. 39).

[1]ASTM Test Method, unless otherwise noted.

[2]Whichever frequency results in the greater number of tests.

[3]Flexible wall permeameter; samples remolded at 80% to 85% maximum dry density.

[4]Must be verified by ASTM D 2216 (Oven) overnight method once every 10 samples.

[5]Acceptable civil engineering practice, as fulfillment of California Code of Regulations, Title 27, Division 2, §21090(a)(1).

[6]Must be verified by ASTM D 1556 (Sand Cone) or D2167 (Balloon) methods once every 20 samples.